

PATENT SPECIFICATION

386,800

Application Date: Feb. 2, 1932. No. 3046/32.

" " May 11, 1932. No. 13,530/32.

" " Aug. 13, 1932. No. 22,745/32.

One Complete Left: Sept. 17, 1932.

Complete Accepted: Jan. 26, 1933.

PROVISIONAL SPECIFICATION.

No. 3046, A.D. 1932.

Improvements in and relating to Groynes.

We, BRAITHWAITE & Co. ENGINEERS LIMITED, a British Company, of Broadway Buildings, Westminster, London, S.W. 1, and FRANCIS MAURICE DU-PLAT-TAYLOR, of 36, Victoria Street, Westminster, S.W. 1, a British Subject, do hereby declare the nature of this invention to be as follows:—

The groynes, one form of which is shown in the accompanying drawings, are formed of screw piles A, spaced at "suitable distances" apart, to which planks B are attached by means of clips C and bolts and washer plates D.

The clips C are so attached that they, and consequently the planks, can slide freely up and down the piles. Only one bolt is inserted in each end of each plank and a space is left between the ends of the planks so that the planks can rotate slightly about the bolts and so adjust themselves to the level of the surface of

the beach or ground.

Limit stop clips E are provided which can be rigidly fixed to the piles in any desired position.

Corrugated or flat iron or steel plates may be substituted for the wooden planks B.

In the accompanying drawings Figure 1. is a part elevation of a groyne, Figure 2 is a horizontal section of the same, and Figure 3 is a cross section of a groyne showing one pile.

This invention is intended to be employed for protection against coastal erosion or for river training and the like purposes.

Dated this 19th day of February, 1932.

For the Applicants:

BARKER, BRETTELL & DUNCAN,
Chartered Patent Agents,
59/60, Chancery Lane, London, W.C. 2.

PROVISIONAL SPECIFICATION.

No. 13,530, A.D. 1932.

Beach Traps or Retainers for Foreshore Protection.

We, BRAITHWAITE AND COMPANY, ENGINEERS LIMITED, a British Company, of Broadway Buildings, Westminster, London, S.W. 1, and FRANCIS MAURICE DU PLAT TAYLOR, a British Subject, of 36, Victoria Street, Westminster, London, S.W. 1, do hereby declare the nature of this invention to be as follows:—

The beach traps or retainers consist of barriers erected on the foreshore so as to catch and retain sand, stones, shingle and other material either driven up by the sea or otherwise deposited while allowing the water to flow back to the sea.

The beach traps or retainers are formed
[Price 1/-]

of perforated metal plates supported by screw piles driven into the ground, the attachment of the plates to the piles being of such a nature as to admit of rapid installation and easy adjustment, and further adjustment in the vertical plane being made by screwing down or unscrewing the screw piles.

The plates may be flat, curved or bent.

In order to illustrate the practical application of the invention two embodiments thereof are described as follows:—

In the first of these flat perforated plates are supported between the projecting portions of the screw piles by means of two curved clips which embrace the

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- pile. Preferably these clips are not rigidly secured to the pile but are slideable thereon so as to permit of ready rotation of the pile for adjustment without disturbance of the plates. In order to prevent the sinking of the plates under their own weight a limit clip may be rigidly secured to the pile immediately beneath the topmost sliding clip.
- 10 In the second application of the invention the plate is bent or arched in section, the landward inclined face being if desired shorter than the seaward inclined face to save unnecessary burying of the
- 15 downwardly projecting edge on account of the slope of the beach. The buried edges of both faces may be flanged to provide more secure anchorage.
- The main anchorage for the plates is, as in the previous instance effected by screw piles which project through the upwardly directed angle of the plates, the piles preferably occurring at the junctions between adjacent sections of plate
- 25 and for this purpose slots may be cut away in the aforesaid angular portion of the plate to permit of these abutting with the piles between them. Beneath the plates, but above beach level each pile preferably carries, bolted thereto, a spreader bar suitably formed to support the inclined faces of the plates.
- Some form of limit clips or cotter may be provided on the pile above the upward angular portion of the plates in order to prevent the latter from lifting off the piles.
- Dated the 5th day of May, 1932.
 BRAITHWAITE & Co. ENGINEERS,
 LTD.,
 For and on behalf of
 Braithwaite & Co. Engineers, Ltd.,
 N. L. ANDERSON,
 Director,
 R. J. N. TAYLOR,
 Director,
 R. J. N. TAYLOR,
 Secretary,
 F. M. DU-PLAT-TAYLOR.

PROVISIONAL SPECIFICATION.

No. 22,745, A.D. 1932.

Improvements in and relating to Groynes.

- We, BRAITHWAITE & COMPANY, ENGINEERS, LIMITED, a British Company, of Broadway Buildings, Westminster, London, S.W. 1, and FRANCIS MATRICE DU-PLAT-TAYLOR, a British Subject, of 36, Victoria Street, Westminster, London, S.W. 1, do hereby declare the nature of this invention to be as follows:—
- This invention relates to improvements in groynes and refers more particularly to certain developments of the invention set forth in our co-pending application for Letters Patent numbered 3046 and dated 2nd February 1932. In accordance with that invention the groynes are carried by screw piles and provision may be made for connecting the intervening planks to the piles so as to be free to slide vertically and to adjust themselves automatically in case of underscouring. The present developments are for the purpose of adapting such groynes for use in submerged positions as for instance below low water level. The prevention of the drift of beach material along the sea bed just below low water mark is very important and for this purpose a groyne some two or three feet in height is required. A similar form of groyne is particularly valuable for purposes of river training. By existing methods of construction it is impracticable to construct a submerged groyne of this character.
- In the construction now proposed the screw piles are formed at their upper ends with means by which detachable connection may be made with a screwing extension bar which is of sufficient length to project permanently above water level. There is preferably used a plug and key square connection between the pile and the screwing extension bar so that the exterior continuity of the combination is uninterrupted. Each pile is provided with a suitable limit stop rigidly secured thereto on which rests a slotted carrier mounted on that portion of the pile projecting from the sea or river bottom. Such a carrier may consist of a sleeve capable of slipping over the pile and having secured to the sleeve oppositely disposed plates which form longitudinal slots on either side of the carrier within which the ends of the intervening planking or shuttering are accommodated. As timber planks are unsuitable for use in a submerged groyne steel members of channel form are preferably employed arranged on edge one above another. To permit of these channel planks becoming inclined they may be of such length that their

ends do not enter the full depth of the slots in the carriers.

The channel planks in any one bay of groyning are preferably interconnected in order to enable the whole of them to be positioned or removed simultaneously by grapnels or similar lifting tackle. In order to permit of the relative movement between the channel planks when they become inclined the connection between them may comprise bolts slidably fitted in slotted holes in the channel planks.

The construction of the submerged groyne is conveniently carried out from a floating pontoon by the following sequence of operations:—

The pile, to which a limit clip is secured in such a position that it will ultimately be on a level with the bottom of the sea or river, is first pitched under water by being lowered in a pile carrier which preferably has internal cam gripping means conveniently operated through a cross arm by cables from the surface of the water. When the pile has been lowered so that its top is at water surface level the screwing extension bar is placed in position. When the point of the pile is resting on the bottom, the pile holder is released, hauled up and removed, and the screwing capstan is fitted over the pile screwing extension bar and the pile screwed down.

Alternatively, the pile holder can be left on the pile in the free condition until screwing is finished, and hauled up after the capstan has been removed.

The slotted carriers for the channel

planks, which are of length substantially equal with the projecting ends of the piles, are then installed being slid down the screwing extension bar. For the purpose of placing the channel planks a temporary length of slotted carrier is used above the permanent one so as to bring the upper ends of the slots above water. In order to orient the slotted carriers a single channel is temporarily placed vertically in the slots on the side away from that on which the horizontal channels are to be placed and by this means the carriers can be kept in the correct alignment.

When at least two piles have been driven the assembly of channel planks in the bay between them is lowered down the slots of the temporary carriers and so led into those of the permanent carriers after which the temporary carriers and screwing extension bars may be removed.

The same working plant may be employed for removing the submerged groyne when beach accumulation or other circumstance makes it desirable. The channel planks are first removed and the piles are subsequently unscrewed. In order to engage the tops of these more easily both the screwing extension bar and the pile holder are provided with flared positioning bells.

Dated this 13th day of August, 1932.

For the Applicants:

BARKER, BRETTELL & DUNCAN,

Chartered Patent Agents,

59 & 60, Chancery Lane, London, W.C. 2.

COMPLETE SPECIFICATION.

Improvements in and relating to Groynes and Beach Traps or Retainers for Foreshore Protection and River Training.

We, BRAITHWAITE & Co. ENGINEERS LIMITED, a British Company, of Broadway Buildings, Westminster, London, S.W. 1, and FRANCIS MAURICE DU-PLAT-TAYLOR, a British Subject, of 36, Victoria Street, Westminster, London, S.W. 1, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in the construction of beach barriers for foreshore protection and river training including groynes and beach traps or retainers. The term "groyne" is used to denote a barrier projecting out into the water and designed to control lateral

drift of the beach or river bed, whilst the term "beach trap or retainer" is used to denote a barrier which is substantially parallel with the shore and designed to accumulate and build up behind itself beach which is washed over it at high water, whilst allowing the water to drain away.

In accordance with the present invention beach barriers are supported and anchored by means of screw piles which are vertically adjustable and which can be withdrawn and reinserted elsewhere.

Hitherto permanent anchorages such as driven piles or concrete embedded posts have been generally used for carrying groynes and the like and as these are not adjustable vertically nor removable with-

out very considerable difficulty the tendency has been for them to become buried so as to require complete renewal. Also with fixed supports of this character it has not hitherto been feasible to graduate the difference in level between the various adjacent sections of beach satisfactorily to avoid sudden drops. In accordance with the present proposal, however, it becomes possible not only to adjust the groynes or beach traps vertically by the screwing or unscrewing of the screw piles in situ but also, when the differences in level become unduly great, to transfer them to intermediate positions by the complete withdrawal of the piles and their insertion in the new positions. The invention thus results in very considerable economy and also in the better protection of the foreshore or river bank.

The invention also provides for the connection of the intermediate planks or shuttering, constituting the actual barrier, to the screw piles so that they are free to slide vertically and thus adjust themselves automatically in case of under-scouring. Such vertical movement may be limited by the provision of stops rigidly secured to the piles in any desired positions. A further feature especially applicable to the construction of groynes is the pivoting of the intermediate planks to vertically sliding clips on the piles and the spacing apart of longitudinally adjoining planks to permit these to become inclined automatically in cases of local scouring.

Screw pile anchored groynes are particularly valuable for use in submerged positions as for instance below low water level. The prevention of the drift of beach material along the sea bed just below low water mark is very important and for this purpose a groyne some two or three feet in height is all that is generally required. A similar form of groyne is also valuable for purposes of river training. By existing methods of construction it is impracticable to construct a submerged groyne of this character.

In the construction of submerged groynes the screw piles are formed at their upper ends with means by which detachable connection may be made with a screwing extension bar which is of sufficient length to project permanently above water level. There is preferably used a plug and key square or equivalent connection between the pile and the screwing extension bar so that the exterior continuity of the combination is uninterrupted. Each pile is provided with a suitable limit stop rigidly secured thereto on which rests a slotted carrier mounted

on that portion of the pile projecting from the sea bed or river bottom. Such a carrier may consist of a sleeve capable of slipping over the pile and having secured to the sleeve oppositely disposed plates which form vertical slots on either side of the carrier within which the ends of the intervening planking or shuttering are accommodated.

Beach traps in accordance with the invention may have perforated metal plates supported between the screw piles and mounted thereon by suitable clips. In order to permit of rapid installation and easy adjustment these clips are preferably a sliding fit on the projecting portions of the piles so that the latter can be readily rotated without disturbing the plates. Limit clips rigidly secured to the piles may be provided as in the case of the groynes in order to prevent the plates becoming detached from the piles or sinking too far into the beach under their own weight.

The beach trap plates may be flat, curved or arched as may be best suited to the conditions encountered. Where the plates are arched in section the landward inclined face may, if desired, be shorter than the seaward inclined face to save unnecessary burying of the downwardly projecting edge on account of the slope of the beach. The buried edges of both faces may be flanged to provide more secure anchorage. The main anchorage for the plates is effected by screw piles which project through the upwardly directed angle of the plates.

In the accompanying drawings showing the invention in its various applications:—

Figure 1 is an elevational view of the projecting portion of one of the piles in a simple groyne showing a method of attaching the intermediate planking thereto;

Figure 2 is a sectional plan on the line 2—2 of Figure 1, and

Figure 3 is a sectional elevation on the line 3—3 of Figure 1 but showing the whole of the pile;

Figures 4 to 8 inclusive relate to the construction of submerged groynes;

Figure 4 being a detail of the method of connecting the upper end of the pile with an extension bar;

Figure 5 being a plan view of the top of the pile;

Figure 6 being a broken side elevation showing the connection between a pile and the metal shuttering adjacent thereto;

Figure 7 being a sectional plan of the same detail as is shown in Figure 6; and

Figure 8 being a sectional elevation of

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the pile carrier used in manipulating the pile whilst it is being pitched or withdrawn;

Figures 9 to 12 inclusive are diagrammatic views of the plant used in constructing or withdrawing submerged groynes showing various stages of progress:

Figures 13 and 14 are front and side elevational views respectively of a construction of beach trap having straight plates;

Figures 15 to 18 inclusive illustrate an alternative construction of beach trap wherein the plates are arched;

Figure 15 being an elevational view of a length of barrier;

Figure 16 being a cross-section thereof;

Figure 17 showing a convenient method of securing the arched plates to the screw piles; and

Figure 18 being a detail of a convenient method of securing together adjacent lengths of plate.

The simple groyne illustrated in Figures 1 to 3 is designed for use in ordinary circumstances where the site is not permanently flooded. The screw piles 10 which may be tubular are provided at the top end with a mild steel disc 11 welded to the top of the pile in such a way as to seal it against entry of air or water. Where the piles are tubular they are driven by means of an apparatus which grips the circumference of the pile for the purpose of transmitting the driving torque. The intermediate planks 12 which are wooden are mounted between the piles and carried therefrom by means of clip bands 13, which embrace one of the piles, washer plates 14 and bolts 15 passing through the planks. The clips are so attached that they can freely slide up and down the piles. Only one bolt 15 is inserted through each end of each plank and a space 16 is left between the ends of longitudinally adjoining planks so that the planks are free to rotate slightly about the bolts and so to adjust themselves automatically to the level of the surface of the beach. In addition and for the same reason the holes 15a in the ends of the planks through which the bolts 15 pass, are slotted longitudinally. The ends of the timbers may be reinforced by means of galvanised steel wrappers 12a which are spiked to the timbers and punched with slotted holes to register with those in the ends of the planks. Limit stop clips 17 are provided which can readily be fixed to the piles in any desired position. Corrugated or flat iron or steel plates may be substituted for the wooden planks 12.

Where the groynes are used in permanently submerged positions a modified

construction is necessary which will now be described. The general arrangements are best shown in Figures 9 to 12 whilst certain details are illustrated to a larger scale in Figures 4 to 8. The screw piles 18 are in this case designed to project from two to three feet from the ground, and in order to drive them use is made of extension bars 19 which are of sufficient length to project permanently above the water. The detachable connection between a bar 19 and the top of a pile is illustrated in Figures 4 and 5. The square plug 20 is secured in the top end of the pile and the socket part 21 is secured in the bottom end of the extension bar, both pile and extension bar being of tubular construction. The exterior surface of the combination is in this way made continuous for the purpose which will presently be described. Each pile is provided with a limit clip 22 bolted around the pile to connect it rigidly thereto at a point such that it will be at ground level when the pile has been screwed home. On the clip 22 rests a carrier 23 mounted on the projecting portion of the pile, and consisting of a sleeve 24 (best shown in Figures 6 and 7) capable of slipping over the pile and having secured to the sleeve oppositely disposed plates 25 the projecting edges of which form vertical slots 26 on either side of the carrier within which the ends of intermediate planking or shuttering are accommodated.

As timber is unsuitable for use in a submerged groyne, steel planks are preferably employed. These may be of the channel form illustrated by reference 28 and arranged on edge one above another. To permit of these steel planks becoming automatically inclined they are of such length that their ends do not enter the full depth of the slots 26 in the carriers. The steel planks in any one bay of groyning are preferably interconnected so as to enable the whole of them to be positioned or removed simultaneously by grappels or similar lifting tackle. In order to permit of the relative movement between the planks the connection between them may be slidable, conveniently comprising bolts 29 slidably fitted in slotted holes 30 in the planks.

The construction of the submerged groyne is conveniently carried out from a floating pontoon 31 by the following sequence of operations:—

The pile 18, to which a limit clip 22 is secured in such a position that it will ultimately be on a level with the bed 32 of the sea or river, is first pitched under water by being lowered in a pile carrier 34, illustrated in detail in Figure 8,

which preferably has internal cam gripping means 35 conveniently operated through a cross arm 36 by cables 37 from the surface of the water. When the pile 5 has been lowered so that its top is at water surface level the screwing extension bar 19 is placed in position. When the point of the pile is resting on the bottom, as shown in Figure 9, the pile holder is released, hauled up and removed, and the screwing capstan 38 is fitted over the pile screwing extension bar and the pile screwed down, as shown in Figure 10.

Alternatively, the pile holder can be left on the pile in the free condition until screwing is finished, and hauled up after the capstan has been removed.

The slotted carriers 23 for the channel planks 28, which are of length substantially equal with the projecting ends of the piles, are then installed being slid down the screwing extension bar. For the purpose of placing the channel planks a temporary length 39 of slotted carrier is used above the permanent one 23 so as to bring the upper ends of the slots above water. In order to orient the slotted carriers a single channel may be temporarily placed vertically in the slots on the side away from that on which the horizontal channels are to be placed and by this means the carriers can be kept in the correct alignment. The placing in position of the permanent and temporary carriers is shown in Figure 11.

When at least two piles have been driven the assembly of channel planks in the bay between them is lowered down the slots of the temporary carriers and so led into those of the permanent carriers after which the temporary carriers and screwing extension bars may be removed.

The same working plant may be employed for removing the submerged groyne, as shown in Figure 12, when beach accumulation or other circumstance makes it desirable. The channel planks are first removed and the piles are subsequently unscrewed. In order to engage the tops of these more easily both the unscrewing extension bar and the pile holder are provided with flared positioning bells, bearing references 40 and 41 respectively.

In order to illustrate the practicable application of the invention to the construction of beach traps two embodiments thereof are illustrated.

In the first of these shown in Figures 60 13 and 14, flat perforated plates 42 are supported between the projecting portions of the screw piles 43 by means of two curved clips 44 which embrace the pile. Preferably these clips are not rigidly 65 secured to the pile but are slidable there-

on so as to permit of ready rotation of the pile for adjustment without disturbance of the plates. In order to prevent the sinking of the plates under their own weight a limit clip 45 is rigidly secured to the pile immediately beneath the top-most sliding clip. 70

In the second construction of beach trap illustrated in Figures 15 to 18 the plates are arched in section, the landward inclined face 46 being shorter than the seaward inclined face 47 to save unnecessary burying of the downwardly projecting edge on account of the slope of the beach. The buried edges 48 of both faces may be flanged to provide more secure anchorage. 75

The main anchorage for the plates is, as in the previous instance, effected by screw piles 49 which project through the upwardly directed angle 50 of the plates. The piles may occur at the junctions between adjacent sections of plate and for this purpose slots may be cut away in the aforesaid angular portion of the plate to permit of these abutting with the piles between them. In another arrangement which is illustrated the top ends of the piles project through holes in the angular portion of the plates away from the ends of the sections, clips 51 of the type already described being rigidly secured to the piles immediately above the plates with curved washers 52 between them if desired. The clips are designed to prevent the plates from lifting off the piles. Adjacent sections of plate may be joined together by means of small plugs 53 projecting through registering perforations and secured in position by means of transverse cotters 54. 80 85 90 95 100 105

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:— 110

1. An improved beach barrier which is supported and anchored by means of screw piles so as to be vertically adjustable and completely removable. 115

2. An improved beach barrier in which planks or shuttering are mounted on screw piles so that they are free to slide vertically and thus to adjust themselves automatically in case of underscouring. 120

3. An improved beach barrier as claimed in claim 2, wherein the vertical movement of the planks or shuttering is limited by the provision of stops rigidly secured to the piles. 125

4. An improved groyne having the characteristic features claimed in either of claims 2 or 3, wherein longitudinal adjoining planks in adjacent bays of the groyne between the screw piles are spaced 130

apart to permit of their becoming inclined automatically in case of local scouring.

5 5. An improved groyne as claimed in claim 4, wherein the planks are mounted at either end by a single pivot only on clips which are slidable on the piles so that the planks are left free to rotate slightly about the pivots as they adjust themselves automatically.

10 6. An improved groyne adapted more particularly for use in permanently submerged positions wherein intermediate shuttering is supported between the projecting portions of screw piles by the provision on the piles of carriers having vertical slots within which the ends of the shuttering are engaged.

20 7. An improved groyne as claimed in claim 6, wherein the carriers each comprise a sleeve portion capable of slipping over the pile and having secured to the sleeve a pair of oppositely disposed plates the projecting edges of which form the vertical slots.

25 8. An improved groyne as claimed in either of claims 6 to 7, wherein a limit clip is rigidly secured to each of the piles at ground level on which the slotted carrier may rest.

30 9. An improved groyne as claimed in any of claims 6, 7 or 8, wherein the intermediate shuttering comprises steel planks of channel section arranged on edge one above another.

35 10. An improved groyne as claimed in claim 8, wherein the steel planks are of such length that their ends do not enter the full depth of the slots in the carriers to permit of the planks becoming automatically inclined.

40 11. An improved groyne as claimed in claim 9, wherein the steel planks in any one bay of groyning are secured together by slidable connections to permit of simultaneous positioning or removal and also relative movement between the planks.

45 12. An improved method of constructing a submerged groyne of the kind claimed in any of claims 6 to 11 inclusive, wherein the pile is screwed from the surface of the water by means of an extension bar whose surface is substantially continuous with that of the pile to permit of the bar also being used for positioning the carrier on the pile.

13. An improved method of constructing a submerged groyne as claimed in claim 12, wherein a temporary length of slotted carrier is mounted on the pile and extension bar above the permanent carrier so as to bring the slots in the latter above water level whilst the shuttering is lowered into position.

60 14. An improved method of constructing a submerged groyne as claimed in either of claims 12 or 13, wherein the pile is pitched by means of a pile holder suspended from above and having internal cam gripping means operated through a cross arm by cables from the surface of the water.

65 15. An improved method of constructing a submerged groyne as claimed in any of claims 12, 13 or 14, wherein the extension bar and the pile holder are provided at their lower ends with flared bells for facilitating engagement with the tops of the piles.

70 16. An improved construction of beach trap having the characteristic features claimed in either of claims 2 or 3, wherein perforated metal plates are supported between screw piles and mounted thereon by suitable clips.

75 17. An improved construction of beach trap as claimed in claim 16, wherein the clips are a sliding fit on the projecting portions of the piles to permit of the latter being rotated without disturbing the plates.

80 18. An improved construction of beach trap as claimed in either of claims 16 or 17, wherein the plates are arched in section, the piles projecting through the upwardly directed angle of the plates.

85 19. An improved construction of beach trap as claimed in any of claims 16, 17 or 18, wherein the landward inclined face is shorter than the seaward inclined face, the buried edges of both faces being flanged.

90 20. The improved constructions of beach barrier substantially as described and as illustrated in the drawings.

Dated this 8th day of September, 1932.

For the Applicants:

BARKER, BRETTELL & DUNCAN,

Chartered Patent Agents,

59 & 60, Chancery Lane, London, W.C. 2.

[This Drawing is a reproduction of the Original on a reduced scale.]

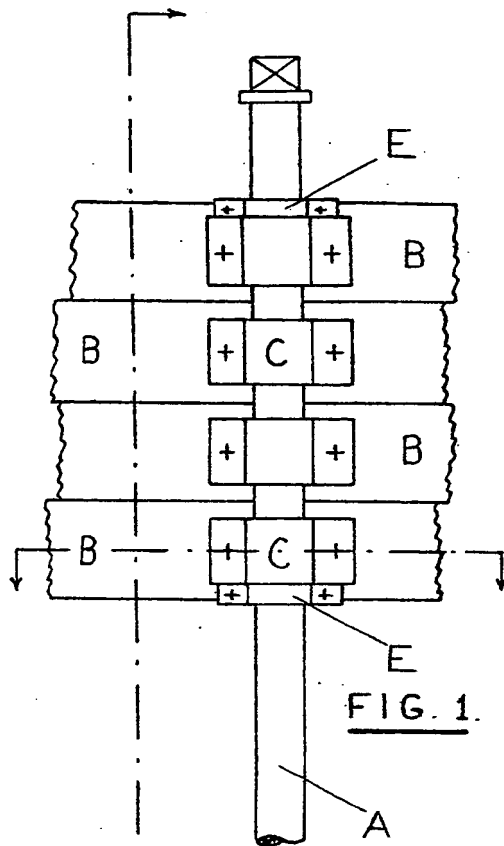


FIG. 1.

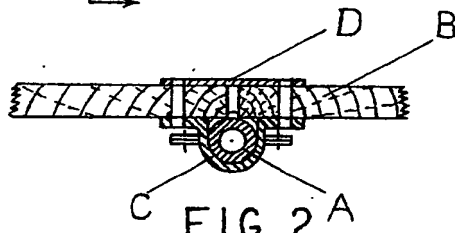


FIG. 2.

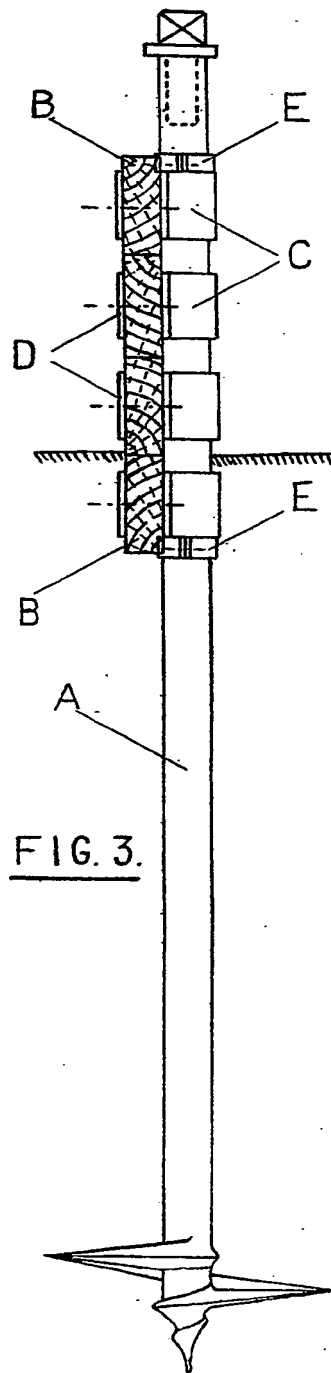


FIG. 3.

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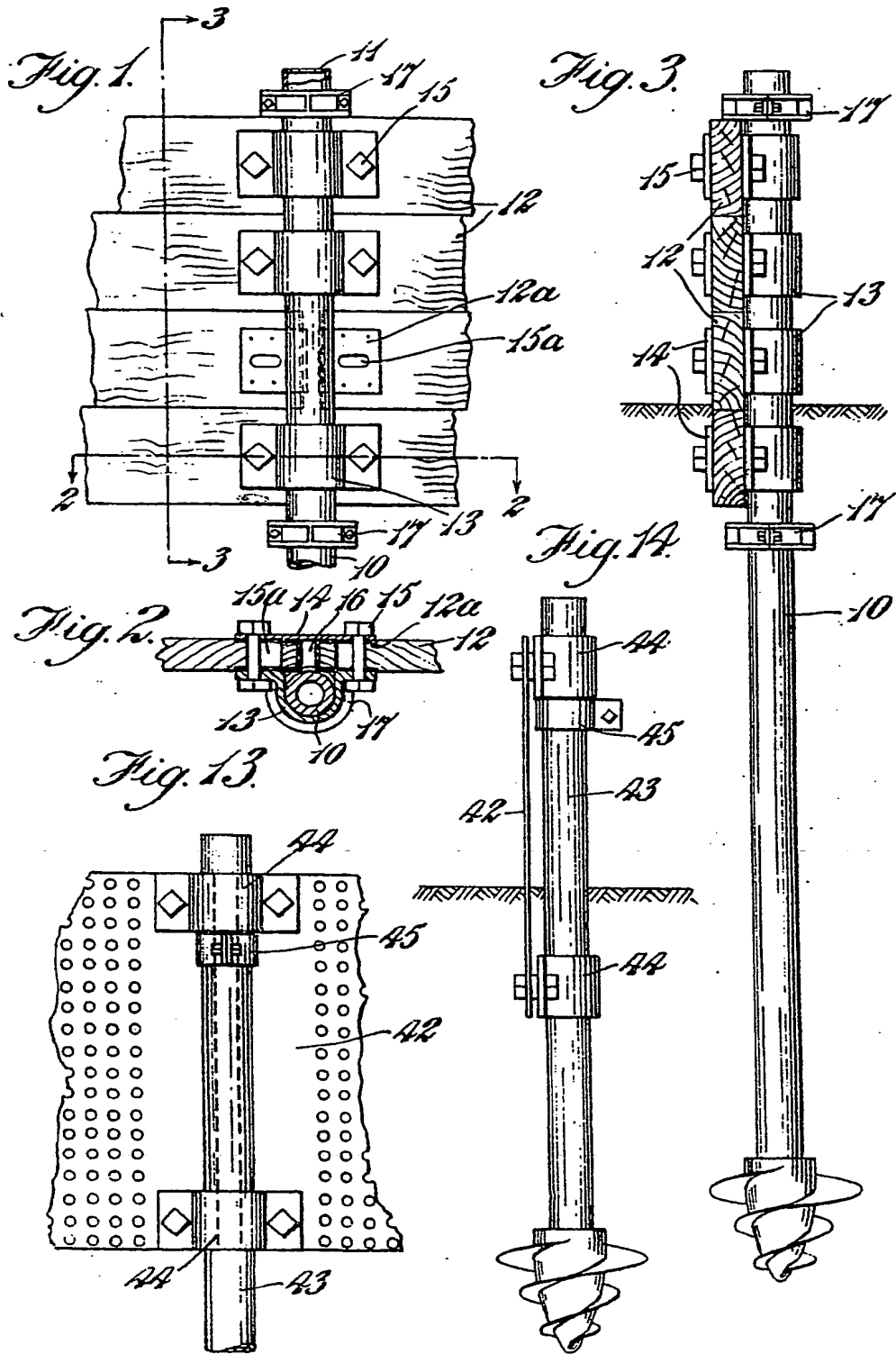


Fig. 4.

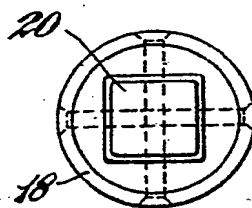
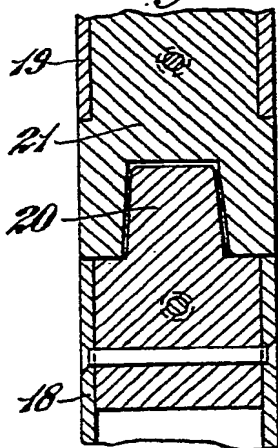


Fig. 5.

Fig. 6.

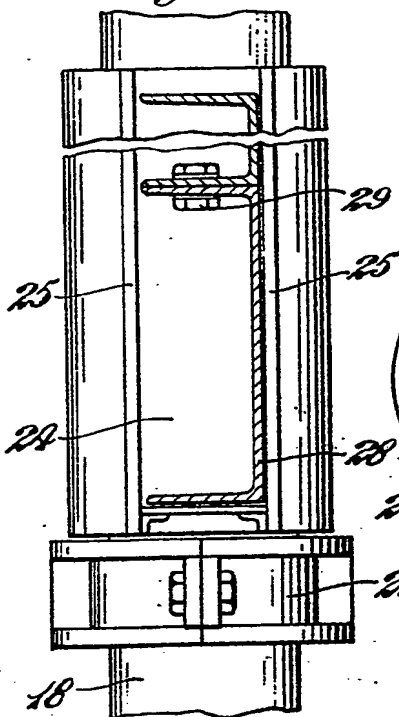


Fig. 7.

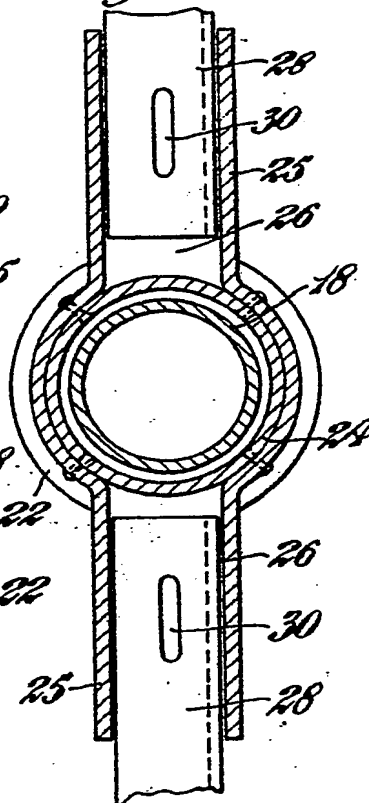
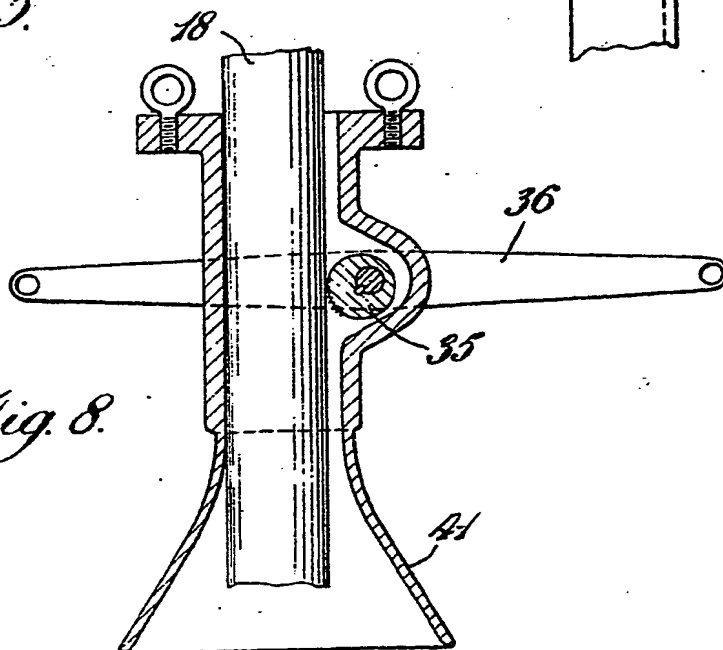
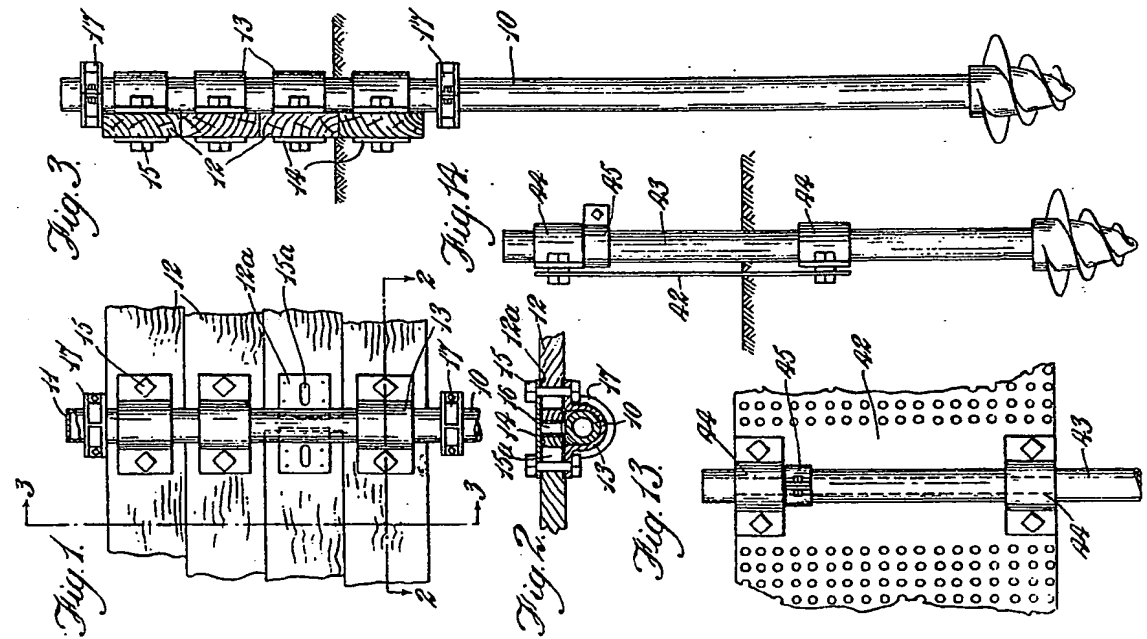


Fig. 8.





[This Drawing is a reproduction of the Original on a reduced scale]

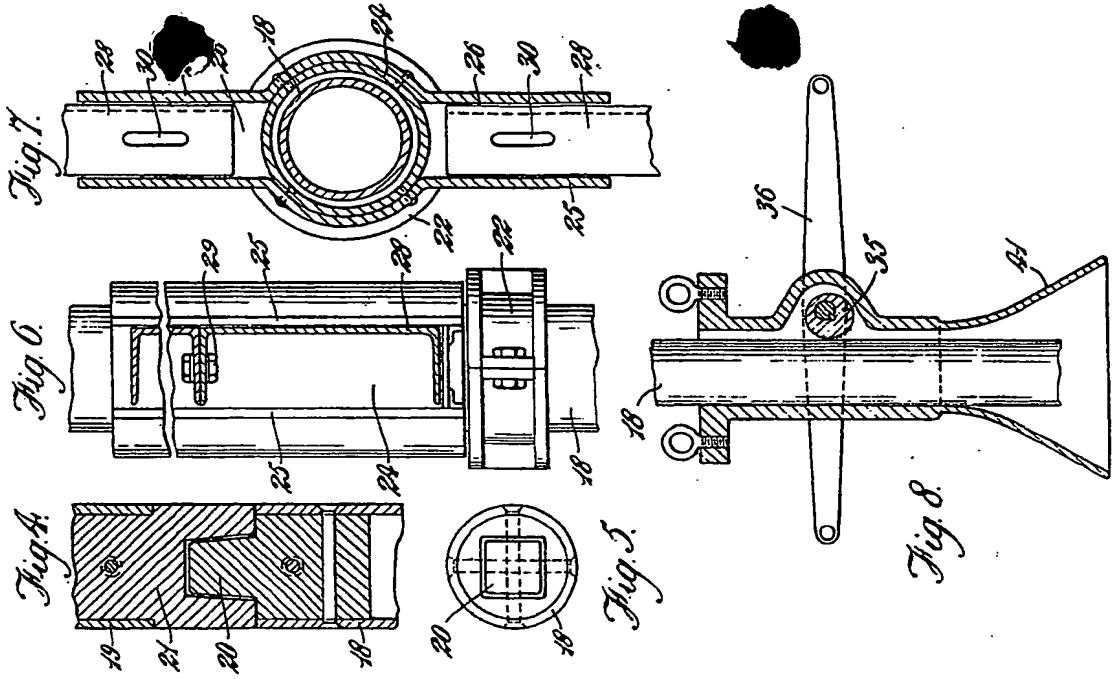


Fig. 9.

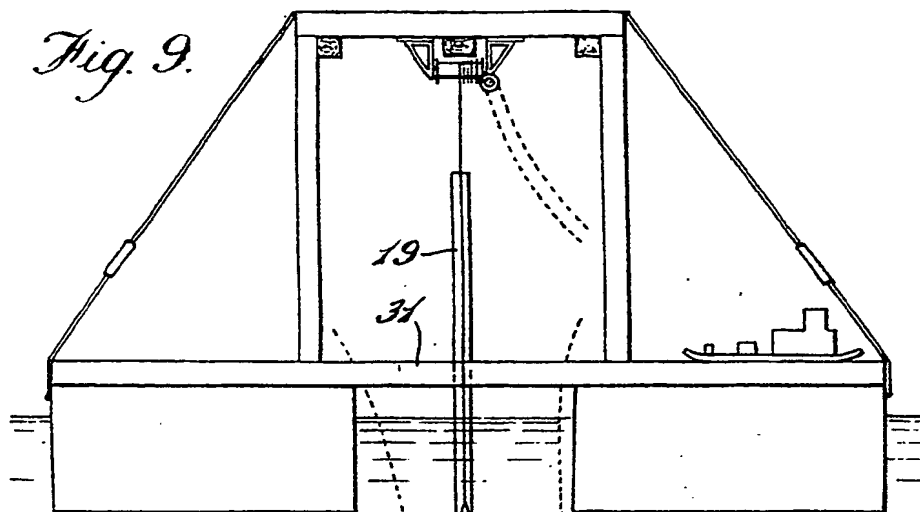


Fig. 10.

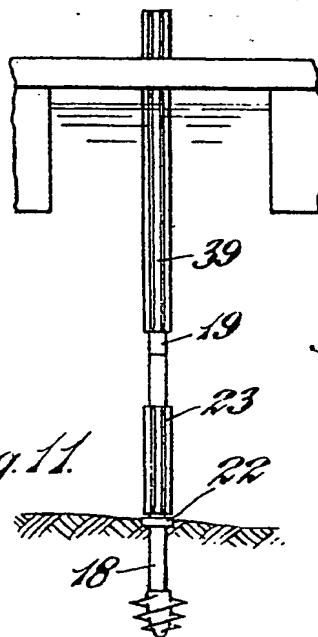
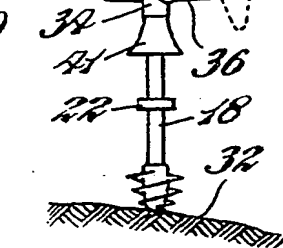
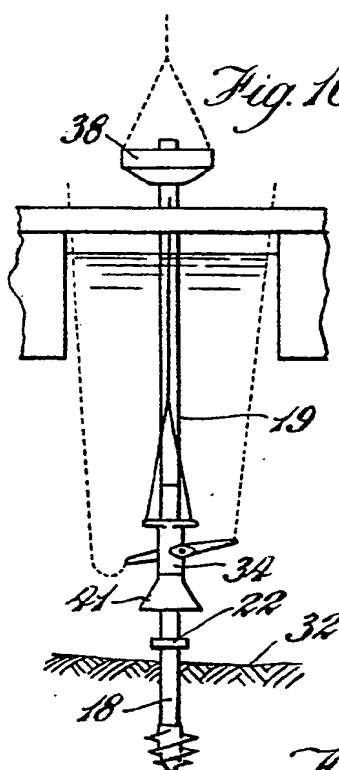


Fig. 11.

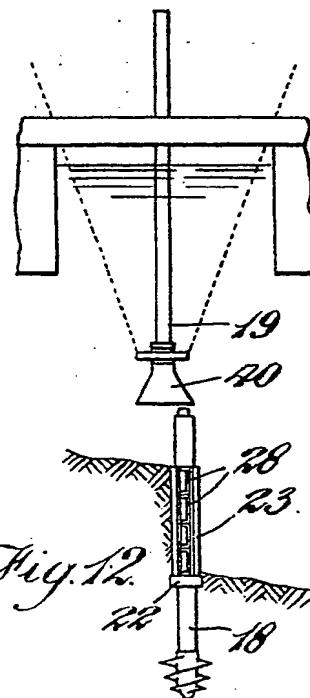
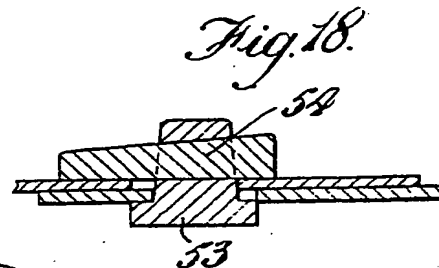
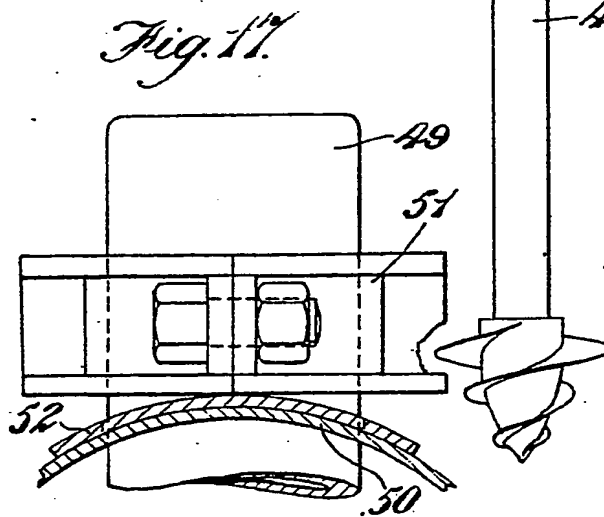
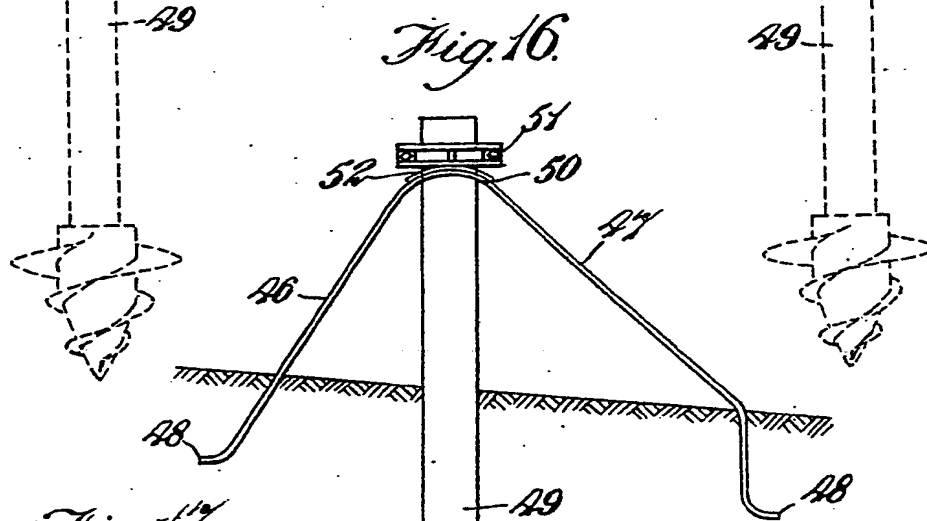
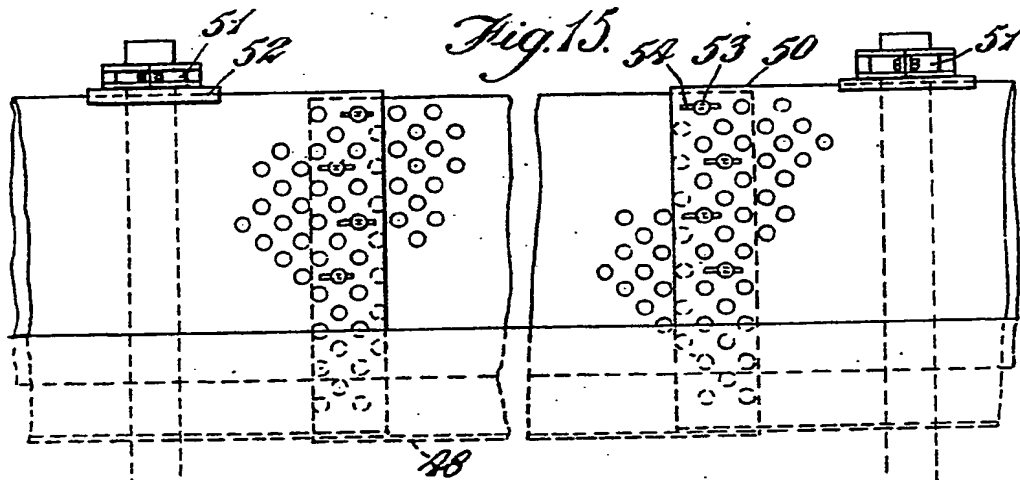
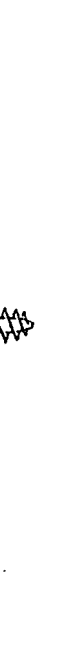
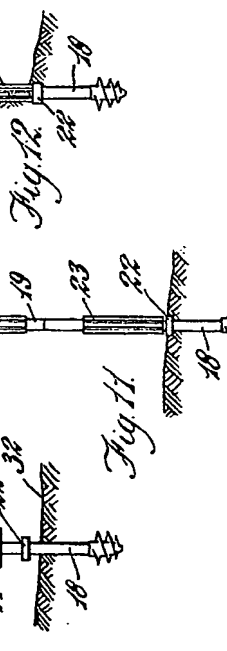
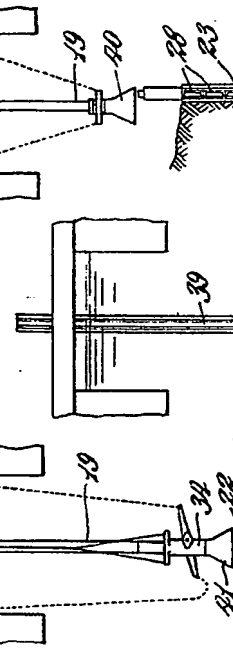
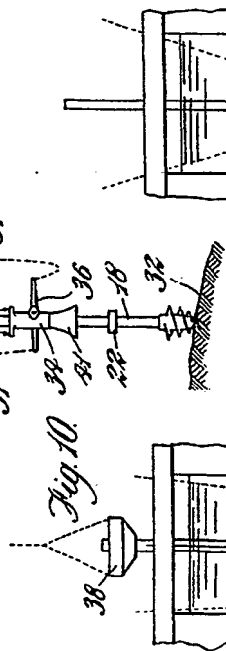
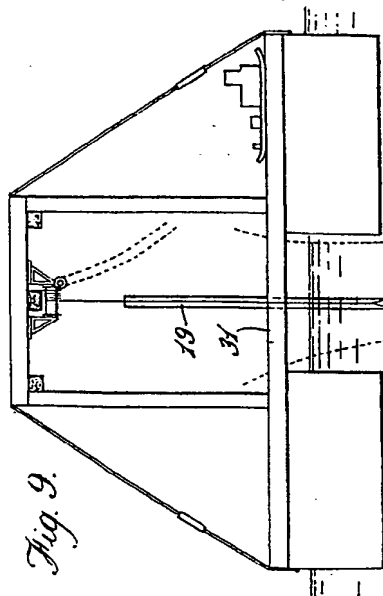


Fig. 12.

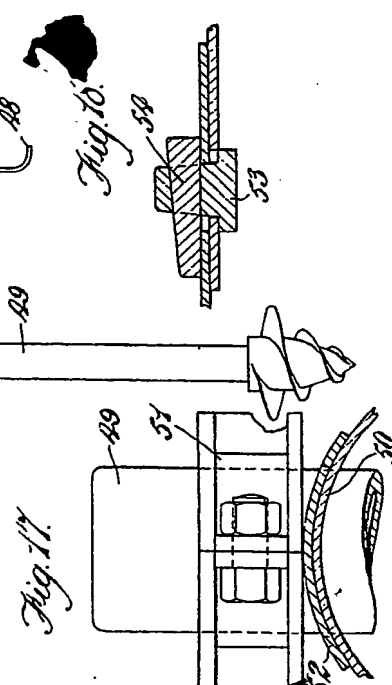
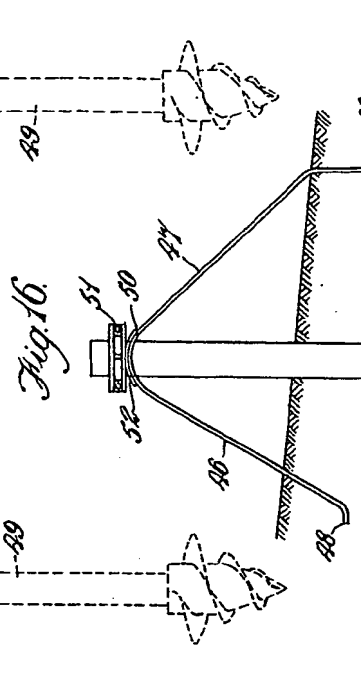
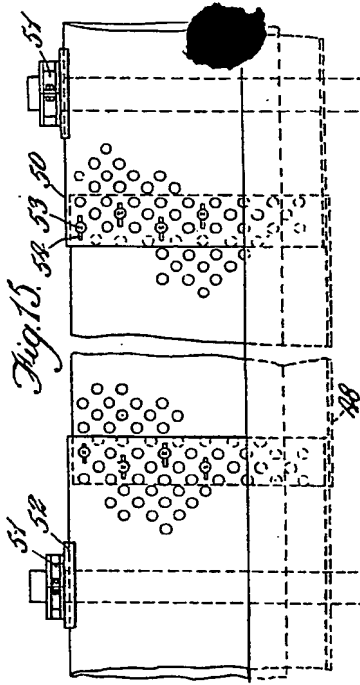
[This Drawing is a reproduction of the Original on a reduced scale.]







[This Drawing is a reproduction of the Original on a reduced scale]



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